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The national fire
incident reporting
system: a key to fire

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THE NATIONAL FIRE INCIDENT REPORTING SYSTEM: A KEY TO FIRE HAZARD QUANTIFICATION

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INTRODUCTION

America Burning, the 1973 Report of the National Commission on Fire Prevention and Control, pointed out that in the United States fire is a major national problem (1). It stated that fire claims nearly 12,000 lives a year, injures some 300,000 and destroys property worth over 4 billion dollars. It stated that the United States leads all the major industrialized countries in per capita deaths and property loss from fire. The death rate is nearly twice that of second-ranking Canada. Among the Commission's recommendations was that a National Fire Data System be established to help place fire prevention and control programs on a firmer foundation of scientific data, and to facilitate development of cost-effective solutions to these problems.

Acting on the recommendation of the Commission, the Congress passed and the President signed the Federal Fire Prevention and Control Act in 1974 (2). The Act dealt with the entire national fire problem and it established the National Fire Prevention and Control Administration. Federal-level responsibility for the collection, analysis, and dissemination of data on the occurrence, control, and results of fires of all types was assigned to the National Fire Data Center of the Administration. The legislative mandate also specified that the program of the Data Center shall be esigned to provide an accurate nationwide analysis of the fire problem, identify major problem areas, assist in setting

priorities, determine possible solutions to problems, and monitor the progress of programs to reduce fire losses. This paper describes the National Fire Incident Reporting System, an ongoing effort undertaken in partial fulfillment of this mandate, and it provides a very brief review of a related activity on the international level.

THE NFIRS CONCEPT AND OPERATION

The primary objective of the National Fire Incident Reporting System (NFIRS) is the collection of national fire loss statistics on fires attended by the fire service, including information on factors involved in fire ignition, spread, and extinguishment. However, the large cost of any system collecting national statistics led to an early policy decision that NFIRS must be more than a mere tool for data collection. Thus, the development or improvement of fire data systems serving the needs of state, regional, municipal, or local fire jurisdictions, as well as federal needs, became a major NFIRS objective. Further considerations led to the establishment of another objective: the standardization and improved uniformity of fire data reporting and collection on all levels.

The NFIRS concept of a national fire data network is based on the cooperation of local, regional, and state fire jurisdictions, and the NFPCA (Figure 1). Data for each fire incident are reported using a nationally uniform coding structure. The incident reports produced by the local fire service can be computer processed at the local or regional level, and then passed on to the state jurisdiction in computerized form (Figure 2). Alternatively, fire incident reports can be sent directly to the state jurisdiction, in which case they are computer processed by the state. All the fire data collected is tabulated and used by

the state for problem analysis and production of annual and periodic reports, as well as feedback reports to the participating fire departments. On the state level, the computerized data are also processed into a national format and sent to the National Fire Data Center (Figure 3). In the Center the data received from all participating state-wide systems are tabulated and analyzed, combined with other data bases, and reports are prepared for feedback to the state sources as well as dissemination to other interested groups.

To insure the maximum possible output versatility, the data coming to the Data Center are stored in the system on tapes essentially as they come in, without condensing. While some standard outputs for the system are already well-defined, it is expected that the data base will be used by a broad group of users, with varied interests and points of view. In addition, important new uses for the data, not anticipated today, are still likely to be found. For this reason it is believed that, at least initially, the system's capability of producing versatile outputs justify the somewhat higher storage costs. Since the initial number of data sources is limited, these costs are not prohibitive.

It is recognized, of course, that in time the NFIRS data base may become very large. When all the States that constitute a representative statistical sample of the nation join NFIRS, it will be possible to decrease the amount of data

in storage. In addition, methods of summarizing and condensing much of the data will be developed in time, so that only a relatively small portion of the total data base will need to reside in costly storage. The remainder of all the data will be stored in an archival mode, where it will be accessible, when needed.

PRELIMINARY TEST OF THE NFIRS CONCEPT

A preliminary test of the system concept was performed in 1974 and 1975 (3). The test was limited to jurisdictions which already collected fire incident data. Results indicated that diverse fire service departments can prepare incident reports using a uniform classification scheme, and that the system can accept reports from several different sources and produce a data base that can be used to produce useful outputs. During this period, it also became apparent that existing local fire service sources will be unable to provide fire incident data that would be representative and descriptive of the national fire experience, but that a number of states were interested in establishing state-wide fire incident reporting systems for their own purposes, but lacked the necessary resources and needed assistance. These states indicated that they would be glad to cooperate with the NFPCA to insure nationwide compatibility of the data for the benefit of their own state and the Nation. Accordingly, a decision was made to adopt officially a uniform classification scheme and a standard vocabulary; develop an official set of data elements and fire incident and fire casualty reporting forms; a training manual for instructors and a handbook for those who will be filling out the forms; as well as a well-documented computer software package for processing the data. The computer package had to be complete, with instructions for keypunching the data from the report sheets at the front end, and programs for producing

reports meeting the basic requirements of the state and local level fire jurisdictions, at the output end. It also had to be flexible to permit the different fire jurisdictions to modify it to fit their own special needs. Sample copies of the forms and the training manual/handbook, and the complete computer package are provided free of charge to state-level jurisdictions willing to participate. A set of states representative of the Nation was identified by a stratified statistical sampling plan, and these states have been assigned a high priority for participation in NFIRS.

THE NFIRS DATA ELEMENTS

Following the established policy guidelines, NFIRS has adopted the uniform classifcation scheme for fire data reporting developed by the Nation's fire community through the voluntary consensus mechanism of the National Fire Protection Association's Committee on Fire Reporting (4). All data elements collected by NFIRS are based on this classification scheme, and all are included in the incident and casualty report forms developed by the Committee. The Committee also agreed to identify the data elements collected by NFIRS by small black triangles in the upper left-hand corners of the appropriate data element boxes. This permits fire jurisdictions that participate in NFIRS to use these forms readily, and the NFPCA adopted them (Figures 4 and 5). It should be pointed out, however, that NFIRS does not require the use of these or any other specified forms. Each participating jurisdiction is free to design its own, as long as the data elements are based on the uniform classification scheme and the standard vocabulary adopted by NFIRS, and the form includes the nationally collected data elements.

While a sincere effort was made to make the selection of the data elements collected by NFIRS on the objective basis of utility and availability, inevitably the list had to be a compromise between those who wish to keep the incident report as simple and short as possible to minimize the effort necessary to fill it out, and those who insist that comprehensive

data on factors involved in fire ignition, spread, and extinguishment must be gathered to make possible the development of rationally justifiable and meaningful fire prevention and control programs. While only extensive experience will show how close the NFIRS set of data elements is to optimum, the following discussion indicates how the NFIRS elements relate to the objectives of the system in terms of their usefulness in identifying and characterizing the fire hazard.

Just what do we want to know about a fire when we try to identify and characterize the hazards associated with it? The answer to this question is not as easy as it may appear at first glance. However, while there may not be a consensus on this point, there appears to be an agreement on at least some of them: information on when and where the fire happened; on the causal factors; on fire growth; on the place in which the fire happened; on the total dollar loss; and on casualties. These categories will serve as examples.

The "when and where" information is provided by questions on lines A and B of the NFPCA Incident Report Form. Information on date, day of week, and time of day makes it possible to correlate the frequency of incidents, their severity, and other characteristics, with temporal factors, such as daily activity patterns, or the seasons of the year. The zip code and Census Tract information provide the geographical coordinates which permit linkage of the fire data with, for example, demographic and socio-economic data in the files of the Census Bureau.

Information on causal factors is provided by the questions on lines K and L of the form. The first of these is concerned with the ignition source and whether it was a piece of equipment. Information on this point is of vital importance to equipment manufacturers, as well as to regulatory agencies, such as the Consumer Product Safety Commission, because it identifies equipment and products that require further attention. For this reason, if it is a piece of equipment that was involved in ignition, further questions are asked about it on line T of the form -- the make, year, model, serial number, and voltage.

The second question in this series asks about the form of the ignition energy -- whether it was the heat from a burning cigarette, or a spark from an open fire. The next two questions are concerned with the nature and the form of the first item ignited, and the final one is concerned with the condition or situation -- the action or lack of action -- that permitted the heat from the ignition source to cause the ignition of the first item.

All these questions have been very carefully defined and selected, so that when the answers are considered together they can provide the information necessary for reconstructing the causal chain of events that led to the fire. Fore example, if the equipment involved was an "electric iron", the heat of ignition was "heat from properly operating electrical equipment", the type of material first ignited was "wearing apparel not on a

person and the ignition factor was "unattended operation", the cause of fire can be readily visualized.

Information on fire growth is provided by the questions on lines M, N, and O. It is made up of several components, and like the information on fire cause, it is most useful when these components are related to each other and to other information about the fire. One component is concerned with the extent of the spread -- was the flame, or smoke, or water damage confined to the object of origin? to the room of origin? to the floor? Did it extend beyond the building of origin? Obviously, this information in itself has a limited value. But if a high correlation were found between extent of smoke damage and, say, polystyrene as the type of material first ignited, this would have some interesting implications concerning the fire hazard of polystyrene products.

The second component of the fire growth complex is concerned with what helped it most to grow. After all, it is not always the first item ignited that is the culprit -- the important factor in fire spread. It could have been the second or even the third item ignited -- the drapery that spread the fire across the room in no time at all, but was ignited from a small wastebasket fire started by a glowing match. The third component is concerned with the path taken by the spreading fire -- did it move up an open staircase? did it spread across a long hall without fire doors? or did it move through to a hole in a fire wall? The collecting of information

on these two aspects of fire growth is a relatively new development in fire reporting, and during the initial stages, the system will not accumulate it on the National level. However, because the inferences that can be drawn from data on these points should be of much value to those concerned with life safety codes, architects, builders, makers of furniture, furnishings, and countless others, the system provides for recording and collection of the data on the state level.

Information on the place where the fire happened is provided by a series of questions on lines H, I, and J. They deal with type of structure in which the fire occurred, the construction type and method, and the use to which the property was put at the time of the fire. Data derived from answers to the first of these questions permits the analysis of fire incidence statistics in terms of the type of structures involved, such as buildings, tents, bridges, or underground structures. Information on construction type permits analysis in terms of standard constructions that differ in fire resistance and stability under fire conditons, such as fire resistive structures, heavy timber, or unprotected wood frame. The terminology used in the system is based on an NFPA Standard (5), which can be related to the several building codes in use in the United States, such as the Basic Building Code, Standard Building Code, and the Uniform Building Code. The data should, therefore, be useful for establishing code requirements and monitoring their effectiveness.

Data on methods of construction is meant to help in identifying differences that may exist between the behavior in fire of structures built on the site and those built in a factory in a modular form or assembled on the site.

Information on fixed property use allows analysis of the fire problem on the basis of property use -- one of the most popular ways of analyzing fire data. Many of the codes and regulations, and much of the effort in the fire area is directed at problems presented in terms of a particular type of occupancy such as manufacturing plants, restaurants, nursing homes, hospitals, apartments, or single-family dwellings. The rational way of establishing the criteria for these codes and regulations, and of allocating priorities to these efforts is on the basis of fire hazard associated with each occupancy type as identified and quantified by fire experience data.

Information on the dollar losses resulting from fires is one major factor in determining priorities for, and determining the cost-effectiveness of, programs aimed at combatting the fire problem. Unfortunately, reliable dollar loss data are hard to come by, because fire service personnel are not schooled appraisers. The multitude of methods for loss estimates -- original cost, market value, replacement cost -- is another obstacle to obtaining comparable data. Since information on total dollar loss is so important, both a dollar estimate and a range are asked for on line Q of the form.

The instructions explicitly request that the estimates be made on the basis of cost of replacement in like kind and quality, and that only the direct physical loss -- to the structure, contents, machinery, equipment, and such, be considered.

The identification and characterization of casualties resulting from a fire has always been an integral part of fire reporting. NFIRS collects information on fire casualties on a separate casualty report (Figure 5), which calls for information on the victim's age and sex, affiliation, and casualty type and severity. Other questions, such as those concerning the nature of the injury, part of body injured, and disposition, or those concerning familiarity with structure and conditions preventing escape, are designed to provide additional information about fire casualties, for analysis and correlation with the various fire incident parameters. For example, if the data show that lack of familiarity with structure is an important factor, an educational campaign to get people familiar with the structures in which they live and work would seem indicated to cut down the number of casualties. However, if correlation with incident data shows that lack of familiarity with structure is of importance only for certain types of occupancies, such campaigns could be aimed more precisely and thus be both more effective and more cost effective.

THE NATIONAL FIRE DATA SYSTEM

This discussion did not cover all the data elements on the NFPCA incident reporting form, but it should be apparent from it that when NFIRS is implemented on a scale sufficient to provide data statistically representative of the national fire experience, and the data quality is good, it will be possible to identify the major fire hazards and rank them in order of priority. Still, it should be made clear that while NFIRS is expected to fulfill a significant part of NFPCA's mandate in the fire data area, it was not designed to satisfy all fire data needs. The National Fire Data Center is developing several other data systems, which will supplement NFIRS and together constitute a comprehensive National Fire Data System. Thus, since NFIRS is limited by design to fire incidents attended by the fire service, household surveys, similar to that described in a recent NFPCA publication (6), will be conducted periodically. Also, since NFIRS was not designed to provide the detailed, exhaustive information necessary for suggesting possible solutions to a fire hazard problem, the Data Center has planned and is implementing a network for indepth investigation of specified classes of fires, conducted on a contract basis by well-trained investigators. This effort will be coordinated with a related program conducted at the Center for Fire Research, National Bureau of Standards.

The National Fire Data System is expected to include relevant

fire data from the insurance industry, National Center for Health Statistics, the Consumer Product Safety Commission, and other governmental and private sources. In addition, it will incorporate or establish regular or direct access to other data files necessary for a full understanding of the causes and effects of fires, such as the demographic and socio-economic files of the Census Bureau.

INTERNATIONAL FIRE DATA NETWORK

It is also hoped that at some time in the future the United States National Fire Data System will be a part of an international network of fire data systems. Fire is an international problem, but at the present time it is extremely difficult to compare fire losses in one country with fire losses in another. The statistics, if collected at all, are collected on different bases, with each country including or excluding different types of fire, using its own definitions, and classifying the data in different ways. Reliable statistics on fires involving specific products, in particular, are very scarce. However, efforts to develop a basic international system for fire data, capable of producing statistics that could be compared from country to country, are underway under the auspices of the International Organization for Standardization. Because textile flammability has been recognized as a problem for some years now, the Subcommittee on Burning Behavior of Textiles and Textile Products of the Committee on Textiles assumed responsibility for the effort, with the actual work performed by the Subcommittee's Working Group 6, on Risk Data Analysis (ISO/TC38/SC19/WG 6). The Working Group has held three meetings over the past couple of years -- in Zurich in June 1974, and in Paris in October 1974 and May 1975. The meetings were attended by experts from Australia, Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Norway, Switzerland,

United Kingdom, and the United States of America. The meetings of the parent Subcommittee were also attended by representatives of Austria, Denmark, Finland, South Africa, Spain, and Sweden, so that these countries also had an opportunity to participate in the effort.

We have exchanged information about the status of fire data systems in the various countries, and I might mention that they range from rudimentary ones all the way to sophisticated systems, such as that in France, which is capable of producing complex reports and answering queries.

Having become acquainted with one another and with fire data systems in each other's countries, the members of the Working Group agreed that because it would be impractical to collect detailed data on all fire incidents it is necessary that a bi-level system be established. The concept is similar to that adopted in the United States in that the system would collect statistical data on all fires and detailed data through in-depth investigation of an appropriate sample of fires of a specified type. The Working Group also agreed that maximum use should be made of existing systems and other existing resources.

To achieve these objectives, the Working Group agreed that its members will: send information on statistical data on all fires to the United States -- to the National Fire Data Center -- for a preliminary examination and perhaps the development of a tentative list of data elements to be used in a standard

international fire incident reporting form; and send detailed reports on textile reports to Dr. Janet Thompson of the United Kingdom, for the same purpose. Following the Working Group's meetings, the Subcommittee in a plenary session reviewed these plans and formally endorsed the effort to examine data from a number of different countries, evaluate it, and try to propose standardized international forms for reporting fire incidents.

The exact date and place of the next meeting of WG-6 has not yet been set, though the U.S. delegation has issued an official invitation to the Subcommittee to meet in the USA in September 1977. This is more than a year from now, but the tasks undertaken by the Subcommittee and its Risk Data Analysis Working Group are very substantial, and we are already behind schedule. Still, progress is being made. We have been able to define what we want to do, and agreed on how to do it. This, I am told, is half the battle.

I am optimistic that it will not be very long before standard national and international fire statistics become available and permit us to learn what is the magnitude of the fire problem, what are the high-priority areas for standards, codes, public education, and research, and through data analysis be able to contribute to the solving of the nation's and the world's fire problems.

NFIRS

National Fire Incident Reporting System

an activity of the

NATIONAL FIRE DATA CENTER

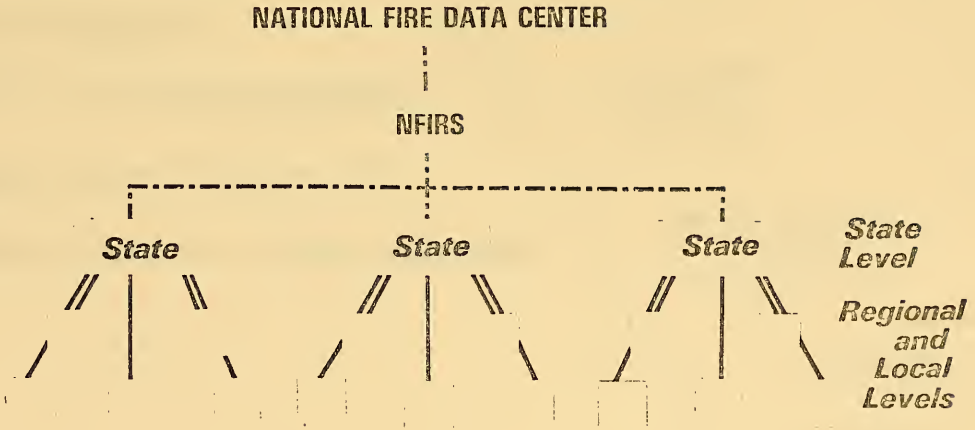

Figure 1

Fire Report Flow of Information from Fire Scene to National Fire Data Center

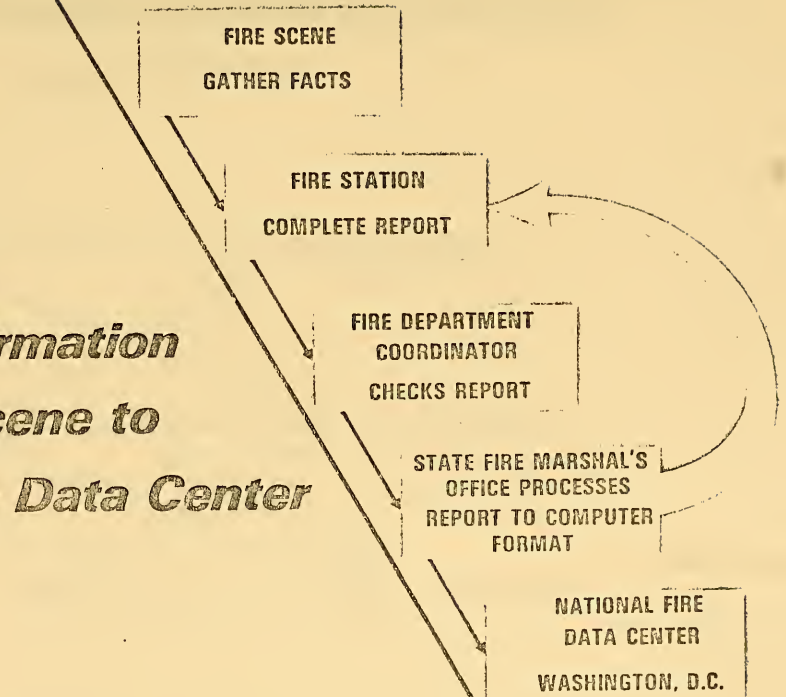

Figure 2

Flow of Information (Reports and Analysis) from NFPCA

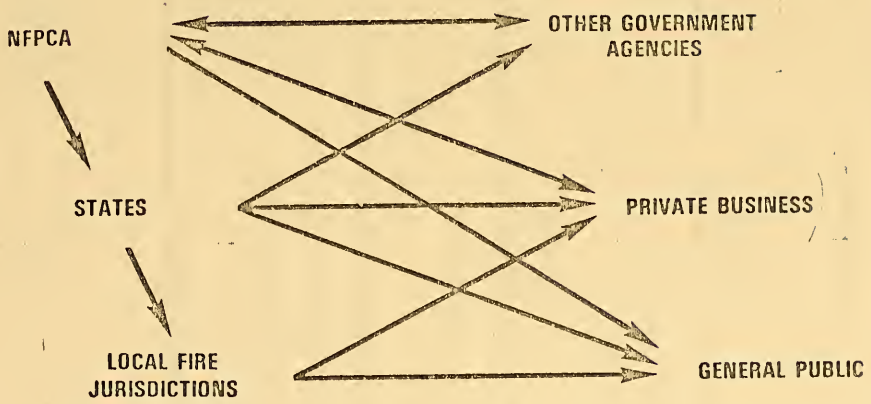

Figure 3

Fill In This Report In Your Own Words

NFPCA INCIDENT REPORT

☐ Revised Report

COMPLETE ON ALL INCIDENTS

1 | FD ID | Incident No. | Exp. No. | Mo. | Day | Year | Day of the Week | Alarm Time | Time—"In Service"

CORRECT ADDRESS: | No. | Dir. | Name | Type | Zip Code | Census Tract

Occupant Name | Telephone | Room or Apt.

Owner Name | Address | Telephone

Method of Alarm from Public | Type of Situation Found

Type of Action Taken | Co. Inspection District | Shift | No. Alarms | Mutual Aid 1 ☐ Rec'd 2 ☐ Given

No. Fire Service Personnel Used at Scene | No. Engines Used at Scene | No. Aerial Apparatus Used at Scene | No. Other Vehicles Used at Scene

COMPLETE IF CASUALTY OR FIRE

2 | No. Incident-related Injuries* Fire Service | Others | No. Incident-related Fatalities* Fire Service | Others | Structure Type

Fixed Property Use | Complex | Mobile Property Type**

Area of Fire Origin | Level of Fire Origin | Construction Type | Construction Method

IGNITION

Equipment Involved in Ignition (if any)** | Form of Heat of Ignition

Type of Material Ignited | Form of Material Ignited | Ignition Factor

COMPLETE IF FIRE

FIRE GROWTH

Extent of Flame Damage | IF FLAME SPREAD BEYOND ROOM OF ORIGIN: | Type of Material Generating Most Flame | Avenue of Flame Travel

Extent of Smoke Damage | IF SMOKE SPREAD BEYOND ROOM OF ORIGIN: | Type of Material Generating Most Smoke | Avenue of Smoke Travel

Extent of Water Damage | Extent of Fire Control Damage | Termination Stage

COMBAT

Time from Alarm to Agent Application | Method of Extinguishment | Detector Performance

Estimated Total Dollar Loss | Property Damage Classification | Sprinkler Performance

COMPLETE ON ALL

R Officer in Charge (Name, Position, Assignment) Date

Member Making Report (If Different from Above) Date

☛ Collected by the National Fire Data System

*List name, age, sex, and description of injury for each casualty on form 902G.

**Complete Line S and/or T

☐ Check box if remarks are made on reverse side.

3 | If Mobile Property | Year | Make | Model | Serial No. | License No. (If any)

4 | If Equipment Involved in Ignition | Year | Make | Model | Serial No. | Voltage (if any)

Form NFDS 902F 2-76
41R2916 Expires 4-77

Figure 4

Fire Department

902G

Fill In This Report
In Your Own Words

NFPCA CASUALTY REPORT

FD ID	Incident No.	Exp. No.	Mo.	Day	Year	Day of Week	Alarm Time
5							

Page. . . . . of . . . . . .

CASUALTY 1

Casualty Number | ☐ Revised Report

Casualty Last Name	First Name	MI	D.O.B.	Age	Time of Injury

Home Address | Telephone

SEX
1☐ Male
2☐ Female

CASUALTY TYPE
1☐ Fire Casualty
2☐ Action Casualty
3☐ EMS Casualty

SEVERITY
1☐ Injury
2☐ Death

AFFILIATION
1☐ Fire Service
2☐ Other Emergency Personnel
3☐ Civilian

Familiarity With Structure	Location at Ignition	Condition Before Injury
Condition Preventing Escape	**Activity at Time of Injury**	**Cause of Injury**
Nature of Injury	**Part of Body Injured**	**Disposition**

☐ See Remarks on Back ☐ See Additional Report

CASUALTY 2

Casualty Number | ☐ Revised Report

Casualty Last Name	First Name	MI	D.O.B.	Age	Time of Injury

Home Address | Telephone

SEX
1☐ Male
2☐ Female

CASUALTY TYPE
1☐ Fire Casualty
2☐ Action Casualty
3☐ EMS Casualty

SEVERITY
1☐ Injury
2☐ Death

AFFILIATION
1☐ Fire Service
2☐ Other Emergency Personnel
3☐ Civilian

Familiarity With Structure	Location at Ignition	Condition Before Injury
Conditions Preventing Escape	**Activity at Time of Injury**	**Cause of Injury**
Nature of Injury	**Part of Body Injured**	**Disposition**

☐ See Remarks on Back ☐ See Additional Report

CASUALTY 3

Casualty Number | ☐ Revised Report

Casualty Last Name	First Name	MI	D.O.B.	Age	Time of Injury

Home Address | Telephone

SEX
1☐ Male
2☐ Female

CASUALTY TYPE
1☐ Fire Casualty
2☐ Action Casualty
3☐ EMS Casualty

SEVERITY
1☐ Injury
2☐ Death

AFFILIATION
1☐ Fire Service
2☐ Other Emergency Personnel
3☐ Civilian

Familiarity With Structure	Location at Ignition	Condition Before Injury
Conditions Preventing Escape	**Activity at Time of Injury**	**Cause of Injury**
Nature of Injury	**Part of Body Injured**	**Disposition**

☐ See Remarks on Back ☐ See Additional Report

Officer in Charge (Name, Position, Assignment) | Date

Member Making Report (If Different From Above) | Date

☐ Collected by the National Fire Data System

R

Form NFDS 902G 2-76

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FEB 93			
8/23/09			

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TITLE THE NATIONAL FIRE INCIDENT REPORTING SYSTEM: A KEY TO

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incident reporting
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Learning Resource Center
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